

# HIGH TEMPERATURE SUPERCONDUCTIVITY

## BRINGING NEW POWER TO ELECTRICITY

### NEWS UPDATE

29 January 2001

---

#### CONTENTS

##### Fifteen Years Since the Discovery of High-Temperature Superconductivity

[The Past: Discovery of High-Temperature Superconductivity in 1986](#)

[The Present: Southwire Pilot Project](#)

[The Future: Mapping the Future](#)

##### Superconductivity's Potential for Strengthening the Power Grid

[Is it Relevant to the California Power Crisis?](#)

[Superconductivity Market Assessment and Pollutant Emissions Reductions Reports](#)

##### Superconductivity and the Environment

[EPA Presents Award to Building Powered by Superconducting Cables](#)

##### Other News on Superconductivity

[RABiTS™ Receives Energy100 Award](#)

[University of Wisconsin-Madison wins DOE Energy Efficiency Grant](#)

##### Interesting Superconductivity Websites

[DOE's Office of Scientific and Technical Information](#)

[High-Tc Superconductivity Information Center](#)

---

##### [The Past: Discovery of Superconductivity announced in Switzerland](#)

## SUPERCONDUCTIVITY ACHIEVED AT RECORD HIGH TEMPERATURES

*Discovery by Swiss scientists may have far-reaching future applications*

Zurich, Switzerland, January 28, 1986. Two physicists at an IBM research laboratory in Zurich, Switzerland have reported signs of resistance-free conduction of electric current at the unprecedented high absolute temperature of 35 Kelvin. Researchers Alex Müller and Georg Bednorz report that unlike low-temperature superconductors, which are metallic or semimetallic, these new compounds are ceramic and are capable of achieving superconductivity at



© 2000, U.S. Postal Service

temperatures of up to 35 K (-238 degrees C). Previously, superconductivity had been possible only at much lower temperatures, making widespread practical applications expensive and impractical. Industry observers and scientific experts predict that in the near future, superconductivity will be achievable at even higher temperatures, enabling the use of inexpensive, abundant and environmentally benign liquid nitrogen as a coolant. The same observers predict that superconducting utility power applications will become an important part of our nation's electrical infrastructure in the 21st century. [[Back to top](#)]

*[Müller and Bednorz went on to receive the 1987 Nobel Prize in physics for their discovery of HTS.]*

### [The Present: Southwire Pilot Project Marks One Year Online](#)

## **SOUTHWIRE CELEBRATES ONE YEAR OF OPERATING HTS POWER DELIVERY SYSTEM**

***System Shattering Records With 5,000 Hours of Providing Power to Manufacturing Plants***

Carrollton, Georgia, January 5, 2001. A year after activating its high-temperature superconducting (HTS) power delivery system, Southwire Company provided a glimpse into the superconductor project's future today as it celebrated the anniversary and the system's recent milestone of operating for 5,000 hours at a 100-percent load.

Southwire is negotiating with several utility companies on a project that would install superconducting power cables designed and manufactured by Southwire and its partners in an actual working utility grid, according to R.L.



Hughey, the company's superconductor project manager. Southwire plans to seek partial funding for the project from the U.S. Department of Energy, which co-funded the development of the current power delivery system.

"A year ago, we brought to life the first high-temperature superconducting power delivery system to provide power for an industrial use. In the year and more than 5,000 hours since, the system has exceeded our greatest expectations," Hughey said. "As we look ahead, we hope to advance HTS technology by building cables that are longer and that carry more current at higher voltage. We are equally as excited and confident that our future efforts will meet with the same level of success."

As it explored the possibility of a utility grid project last fall, Southwire commissioned a survey of U.S. utility companies to assess the future demand for HTS cables. While the study should take about six months, preliminary results are expected by the end of January.

Activated on Jan. 5, 2000, Southwire's power delivery system provides power to three manufacturing plants at the company's Carrollton, Georgia headquarters. Nearly immune to resistance, Southwire's HTS cables lose only about a half-percent of power during transmission, compared to 5 to 8 percent lost by traditional cables. The cables also deliver more power, about three to five times more than traditional power cables.

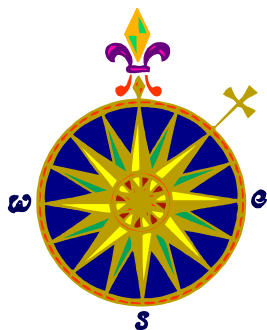
As the rapid growth of urban areas increases demand for electricity, while limiting the space for overhead and underground cable installations, the ability of HTS cables to transmit more power using the same amount of space as traditional cable will be increasingly important. HTS cables can be used underground in areas where more power is needed but space for additional lines is not available. Southwire anticipates a commercial HTS cable could reach the market by the year 2005.

Southwire's partners include the U.S. Department of Energy, which has co-funded the project, and Oak Ridge and Argonne National Laboratories. Industrial partners include Intermagnetics General Corporation and EURUS Technologies, Inc. Electrical utility partners include Southern Company, Georgia Transmission Corporation and Southern California Edison. [from Southwire press release, 5 January 2001; see related story below] [[Back to top](#)]

### The Future: Mapping the Route to Market Commercialization

## COATED CONDUCTOR ROADMAPPING WORKSHOP

Nearly 100 scientists, researchers and other leaders in the U.S. HTS community gathered for a two-day workshop in St. Petersburg, Florida earlier this month entitled Coated Conductor Roadmapping Workshop: Charting our Course. This workshop, which included participants from government agencies and industry companies, took an in-depth look at the current status of U.S. efforts in developing a cost-effective coated superconductor. Using meeting facilitators from Energetics, Inc. trained in developing group consensus in scientific/technical areas, participants examined how government and private efforts could best be focused in order to achieve an affordable, commercially viable coated superconductor within the next five years.



"I believe that the results of this workshop will help guide program efforts in the coming years, as well as facilitate future government-industry partnerships," said Jim Daley, DOE's Superconductivity for Electric Systems Program Manager. "The roadmapping process showed that we have come a long way, but also demonstrated that we have a lot of work left to do in order to achieve commercially viable coated superconductors," he concluded.

For information on the workshop's results once they are released, please contact Joe Badin of Energetics at 410-953-6252, e-mail [jbadin@energetics.com](mailto:jbadin@energetics.com). [[Back to top](#)]

## **Superconductivity's Potential for Strengthening the Power Grid and Increasing Reliability**

In the early 1990's, inefficiencies in the nation's electric grid averaged 7.3%. However, as electric industry restructuring and long-distance wheeling gained momentum, these inefficiencies began to increase dramatically. In 1998 and 1999 (most recent data available), Energy Information Administration (EIA) statistics show that grid losses averaged about 11%.

Such grid inefficiencies mean that more power must be generated to meet demand. Though the ongoing power crisis in California, for example, is primarily due to generation shortfalls, more efficient transmission technologies could have resulted in a small—but significant— increase in electricity available to consumers.

“Superconductivity would not be a panacea for California's power problems,” notes Mohammad Khajavi of the Los Angeles Department of Water and Power. “However, our state's electricity crisis shows the immediate need to upgrade generation capacity and transmission efficiency. This could provide a real ‘window of opportunity’ for promising new technologies such as superconductivity.” [[Back to top](#)]

## **Market Assessment and Pollutant Emissions Reduction Reports for Superconducting Power Applications**

The 2000 edition of Oak Ridge National Laboratory's market assessment report, “High Temperature Superconductivity: the Products and Their Benefits” features a number of predictions about future market applications of superconductivity. Written by Bob Lawrence & Associates of Alexandria, Va., this report takes five classes of electric equipment (motors, transformers, generators, underground cable and fault current limiters) and provides background information, market analysis and predicted commercialization date for each application. This report, and much more information on superconductivity, is available on Oak Ridge's website at <http://www.ornl.gov/HTSC/htsc.html>.

Another report issued by Oak Ridge and authored by Bob Lawrence & Associates is entitled “The Pollutant Emissions Reduction Potential of Superconductive Technologies.” The newly updated draft version of this report (dated January, 2001) concludes that electric power applications using superconductivity have the potential of saving a cumulative 174 million metric tons of carbon equivalent of CO<sub>2</sub>, 2.11 million short tons of SO<sub>2</sub> and 1.01 million tons of NO. For a copy of this report, contact Craig Cox at [coxcrraig@att.net](mailto:coxcrraig@att.net). [[Back to top](#)]

## **Superconductivity and Environmental Stewardship**

The U.S. Environmental Protection Agency (EPA) awarded Southwire Company's Building Wire Plant a charter membership in its new National Environmental Achievement Track last month. The Building Wire Plant is entirely by superconducting power program is one of two levels of



one of the company's facilities powered cables (see [story](#) above). The EPA National Environmental Performance

Track, a new federal program recognizing industries whose environmental programs go beyond federal regulatory requirements and who take extra steps to prevent air, water and land pollution.

“Southwire is honored to support such a groundbreaking program and to be recognized by the EPA for our efforts to ensure a healthy environment,” said Roy Richards, Jr., Southwire’s chairman and chief executive officer. “We work diligently to minimize our environmental impact and constantly seek ways to reduce pollution. Being named a charter member in National Environmental Achievement Track shows we’re headed in the right direction.”

Companies certified at the achievement level enjoy strong histories of compliance with environmental regulations and commitment to improvement in environmental performance. Those industries also operate under environmental management systems to ensure regulatory goals are met. Finally, the charter members work to inform their communities of important issues and respond to community concerns through public outreach programs.

According to EPA, Achievement Track companies and facilities have outstanding records in environmental management. They have reduced their energy consumption by millions of kilowatts per year and are committing to an average of 22 percent improved energy efficiency in the future. Commitments for future water use reductions average 31 percent. Waste reduction at Achievement Track facilities is projected to average 44 percent a year, representing millions of pounds of saved resources as process and packaging materials are recycled or reused. [from Southwire press release, 13 December 2000] [[Back to top](#)]

### **RABiTS™ Award**

The U.S. Department of Energy (DOE) announced recently that Oak Ridge National Laboratory’s “RABiTS”™ (Rolling-Assisted-Biaxially-Textured-Substrates) superconducting wire technology was selected for an Energy100 Award.

Sponsored by the White House Millennium Council, the Energy100 list honors “the best scientific and technological accomplishments DOE has to offer [since its inception in 1977]. These achievements were nominated for review by DOE lab, program and field offices...These discoveries demonstrate our commitment to save consumers money and improve your quality of life. We hope these discoveries serve as an inspiring example of how public investment in innovation can make a difference in your lives.”

Two patents have been granted and five U.S. companies (3M, Oxford Superconducting Technology, MicroCoating Technologies, EURUS Technologies and American Superconductor Corporation) have already licensed this revolutionary new technology for their products. “These special substrates will enable the next generation of high-temperature superconducting wires to be used in transmission cables, transformers, current limiters, and motors and generators — anywhere large amounts of electricity are produced, transmitted, or distributed to customers,” said Robert Hawsey, Oak Ridge National Laboratory’s Superconductivity Program Manager. Hawsey said that the wire will likely be found in devices on the utility side of the electric meter in most cases, but not always. “One of the notable exceptions perhaps will be large, several-thousand horsepower motors used in heavy industry, such as paper or steel mills, or at our

nation's electric power generating stations," Hawsey said. "Further development of the Oak Ridge wire-making process could lead to many industrial or commercial applications of superconductivity where none presently exist."

RABiTST<sup>TM</sup> was developed through funding provided by DOE's Office of Energy Efficiency and Renewable Energy (Office of Power Technologies, Superconductivity Program) and the Office of Science (Division of Materials Science, Basic Energy Sciences Program).

For more information on RABiTST<sup>TM</sup> and the Energy100 awards, visit <http://www.ma.doe.gov/energy100/future/48.html>. [Back to top]

### **University of Wisconsin-Madison wins DOE Energy Efficiency Grant**

In a January 9th press release, former Secretary of Energy Bill Richardson announced that 13 firms have been selected to perform scientific research for energy-efficient power generation, industrial and buildings systems, and transportation. The total grant amount is \$10.9 million.

"These firms will conduct ground-breaking research into the development of more energy-efficient computers, engines, materials and alternative energy systems," said Richardson. "Investment in these technologies should help ease the demand for energy." The goal of the announced research grants is to help bring exploratory research to the point where advanced energy-efficient systems can be developed into commercial products.

One of the 13 DOE awards went to the University of Wisconsin, Madison for pursuing "New Processing and Characterization Approaches for Achieving Full Performance of High Temperature Superconducting Tapes." This grant (estimated amount of \$350,000) will address key issues needed to improve the performance of superconducting tapes to increase their energy efficiency and make them more economical. [Back to top]

### **OSTI Website**



The U.S. Department of Energy's Office of Scientific and Technical Information (OSTI) has a searchable "Superconductivity (SUP) Subject Portal site" which integrates diverse superconductivity research resources from various sources into one location. OSTI "provides a means of searching and accessing databases that can be linked to or searched via either the SUP distributed search engine or the WAIS search engine that retrieves information from the SUP Archive." It provides electronic access to current energy-related, subject-specific

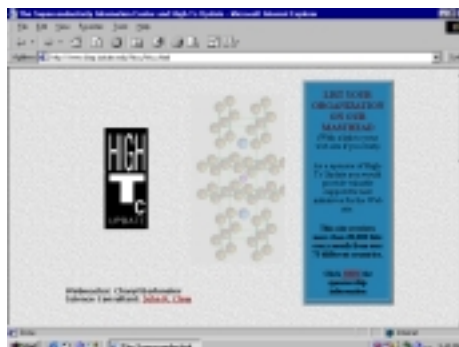
collections of bibliographic citations with abstracts and full-text reports, when available, compiled from a variety of available resources.

This comprehensive database can be visited at <http://www.osti.gov/sup2000/>. [Back to top]



## **High-Tc Superconductivity Information Center Website**

Another excellent website for the superconductivity scientific community is located at <http://www.iitap.iastate.edu/htcu/htcu.html>. Hosted by Iowa State University's Physics Department, the "High-Tc Superconductivity Information Center" website is sponsored by Argonne and Oak Ridge National Laboratories, IGC-SuperPower, LLC (A Subsidiary of Intermagnetics General Corp.) and Nordic Superconductor Technologies A/S.



The website notes that the "High-Tc Superconductivity Information Center and High-Tc Update newsletter were started in April 1987 as a short-term solution for a crisis situation: the need to communicate frequent--almost daily--breakthroughs in high-Tc superconductivity. Over the years, it has become a successful model for how research results can be very effectively communicated." Researchers can visit the website to access recent superconductivity-related research papers, coming events, job openings and other items of interest. [[Back to top](#)]

---

## **ABOUT THIS UPDATE**

The **High-Temperature Superconductivity News Update** is compiled by Bob Lawrence & Associates Inc. on behalf of the U.S. Department of Energy's Oak Ridge National Laboratory Superconductivity Program. It is issued periodically as events warrant.

Please let me know if you would like more information or story ideas on any of these news items involving high-temperature superconductivity---a clean and capable new electricity technology for the 21st century. If you have any other comments or questions, please let me know.

Thank you very much.

Craig Cox  
Bob Lawrence & Associates, Inc.  
[www.bl-a.com](http://www.bl-a.com)  
303-679-9331  
[coxcrraig@att.net](mailto:coxcrraig@att.net)